BRIEF PAPERS

DISTRIBUTION OF TOTAL SOLUBLE SOLIDS, ASCORBIC ACID, TOTAL ACID, AND BROMELIN ACTIVITY IN THE FRUIT OF THE NATAL PINEAPPLE (*ANANAS COMOSUS* L. MERR.)

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During the course of investigations on the cause of physiological breakdown in the fruits of the pineapple (*Ananas comosus* L. Merr.) it was observed that symptoms of this disorder are usually more pronounced in the lower half or lower two thirds of the fruit than in the region just below the crown. It, therefore, seemed desirable to make detailed studies of the distribution of some of the juice constituents of the pineapple, for it appeared that there may be physiological differences between top and bottom segments of the fruit.

The idea of unequal distribution of juice constituents in fruits is not new. BARTHOLOMEW and SINCLAIR (**4**) reported that mature oranges and grapefruits had a considerably higher concentration of total soluble solids in the stylar than in the stem-ends. LALL (**6**) and ARCHBOLD and BARTER (**1**) found that the concentration of soluble solids was higher in the blushed than in the unblushed side of an apple, and that these constituents increased from the stalk-end to blossom-end and from the inside to outside. The latter two investigators noted also that acid content of apples increased from outside to inside of the fruits. According to TUCKER (**10**), soluble solids in the watermelon increase progressively from the rind to the core, the greatest concentration being in the area around the seeds. Ascorbic acid has been reported higher in the peel than in the flesh of citrus fruits (**2**), apples (**5**) and tomatoes (**11**). SIDERIS *et al.* (**8**), in studies of pineapple fruits, found slightly greater amounts of soluble solids and less acid in the flesh than in the shell of the fruits. Apices of both shell and flesh were higher in acid and lower in soluble solids than the bases.

Natal pineapples in the mature green stage of maturity were shipped by railway express from Miami, Florida to Pittsburgh, Pennsylvania. The fruits were ripened at room temperature (25 to 30° C) before sampling. Pineapples were peeled, cored, and then cut into three transverse sections, *i.e.*, top, middle, and bottom. Methods employed for extraction of juice and determination of total soluble solids, total and ascorbic acids were identical with those described elsewhere (**7**). Bromelin activity was estimated by a method which has been recommended by BALLS and HOOVER for quantitative determination of papain (**3**). Thirty pineapples were employed in this study, each fruit being analyzed separately.

Results of the analyses of 30 individual fruits have been averaged and are presented in table I. It will be observed that total soluble solids were higher in the basal than in the middle segments and higher in the latter than in the top portions. Total and ascorbic acids and bromelin activity were highest in the top segments and decreased progressively toward the base of the pineapples.

As a rule, ripening of fruits is accompanied by an increase in soluble solids, a decrease in total acid and in some instances by a decrease in ascorbic acid. The results now being reported indicate that in the so-called mature pineapple, the basal segment is more mature than the middle portion, and this in turn is more mature than the top segment. This result is also confirmed by the progressive decrease in bromelin activity from top to bottom since it has been reported by TANAKA (**9**) that activity of this enzyme tends to decrease with increasing maturity of the pineapple fruit. It is apparent, therefore, that physiological breakdown in pineapples is associated with physiological maturity and that the disorder is similar to breakdown in a number of other fruits in this respect. This observation is borne out by the fact that pineapples which have been chilled while green may not show definite symptoms of physiological breakdown until they become ripe.

TABLE I

WEIGHT, JUICE VOLUME AND DISTRIBUTION OF VARIOUS JUICE CONSTITUENTS IN THREE TRANSVERSE SECTIONS OF THE FRUIT OF THE NATAL PINEAPPLE (AVERAGE OF 30 FRUITS).

Section	Weight	Volume of juice	Total soluble solids	Total acid	Ascorbic acid	Bromelin activity
	gm.	*ml.*	*%*	*gm./100 ml.*	*mg./100 ml.*	*1/t*
Top	160	72	14.7	1.22	28.4	0.539
Middle	202	89	17.1	1.15	21.7	0.497
Bottom	194	83	19.3	1.10	13.2	0.446

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